CIA/ PB 131632-64

UNCLASSIFIED- SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

MAY 1 1959

(65)

PB 131632-64

INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1959

May 1, 1959

U. S. DEPARTMENT OF COMMERCE
Office of Technical Services
Washington 25, D. C.

Published Weekly
Subscription Price $12.00 for the Series

PLEASE NOTE

This report presents unevaluated information on Soviet Bloc activities in the International Geophysical Cooperation program from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM-- SOVIET-BLOC ACTIVITIES

Table of Contents

		Page
I.	General	1
II.	Rockets and Artificial Earth Satellites	2
III.	Upper Atmosphere	13
IV.	Meteorology	15
V.	Gravimetry	17
VI.	Seismology	18
VII.	Arctic and Antarctic	20

I. GENERAL

Polish IGY Report on Chinese Geophysical Station

Under the heading of "IGY Chronicle," the Polish author of a brief article on the Chinese Geophysical Station in Canton states that he left the Polish Geophysical Station in Cha Pa (Vietnam) to reach, after a 3-day train trip, Canton in China. He was sent to visit the Geophysical Station at Shi Lu Gan [probably Shih-liu-Kang] 30 kilometers from Canton, where he was supposed to measure the horizontal component of the terrestrial magnetic field by devices he had brought with him. From these constant records of the components of terrestrial magnetism, the value of records had to be estimated and compared with results obtained by the local station at Shi Lu Gan. Such a comparison was required by the Polish station at Cha Pa to determine the zero point of the instrument, a very important point for absolute measurements.

The Geophysical Station of the Chinese Academy of Sciences was founded in mid-1957. It consists of two sections: the magnetic and the seismic. The first is located in a beautiful, antimagnetic building, insulated from humidity and heat. The recording instruments, a good Chinese copy of the La Cour design, are thermally balanced. An adjoining building serves for absolute measurements. It is provided with a theodolite of the "Cambridge" type, used for absolute measurements of the horizontal component of the magnetic field, as well as declination, and a terrestrial inductor for measuring the inclination of the magnetic field. The results are not yet considered sufficiently good, particularly the measurements of the horizontal component, but this is the trouble most new stations have.

The seismic station is located in the cellar of another building at least 150 meters from the magnetic laboratories. It is provided with a Kirnos seismograph for standard recording of earthquakes. Besides this installation, the station is supplemented by a so-called tripartite station, consisting of three special seismographs installed on hills in the vicinity and forming a triangle with sides of several hundred meters. They are connected with the main station by electrical wiring and a special recorder which indicates small vacillations of the ground, the so-called microseisms. The setting of the instruments in a triangle facilitates distinguishing phase difference and the determination of the direction of the quake, or of an approaching typhoon.

The actual planning of the station is aimed at improving the operation of instruments, providing better methods of analyzing data, and furnishing information on earthquakes and typhoons. The station is also cooperating in the IGY.

Three photographs accompanying the article show a view of the seismological station, a single-story, suburban residence-type structure; Jan Shyan-Yan [Polish romanization], chief of the magnetic station; a group shot of Shi Lu Gan geophysical station personnel of seven men and two women.

("The Chinese Geophysical Station in Canton," by Czeslaw Krolikowski; Warsaw, Problemy, No 2, 1959, pp 137-139)

II. Rockets and Artificial Earth Satellites

Mechta Data Analyzed: First Published Report

The complete text of an article analyzing cosmic ray and terrestrial corpuscularemission data picked up by the Soviet outer space rocket is presented below. CPYRGHT

The cosmic rocket launched in the direction of the Moon on 2 January 1959 was provided with equipment for recording cosmic rays and terrestrial corpuscular emission. The latter is understood to consist of streams of fast charged particles at high altitudes, for which the magnetic field of the Earth provides a so called "magnetic trap," causing the emission to have a relatively high intensity. The equipment installed on the cosmic rocket was aimed at providing, insofar as possible, data related to the two specific questions. The recording of particles was realized by means of two Geiger counters and two scintillation counters. The Geiger counters had 1 x 5 cm and 1.8 x 10 cm dimensions. The walls of the Geiger counters are made of stainless steel 0. 1 mm thick. The installation of two Geiger counters has the purpose, besides a check on the proper functioning of both devices, of yielding a higher accuracy of measurements within a wide range of intensity variation.

The first device with a scintillation counter is in its construction a further development of a device used by us on the third artificial satellite of the Earth. The detector consists of a cylindrical crystal of sodium iodide of 39 x 40 mm size. Measurements were carried out of phenomena with energy thresholds of I - 45 kev ; II - 450 kev ; III - 4.5 Mev and IV - the total ionization produced in the crystal. To avoid nonlinear distortions, the ionization determination was carried out by measuring not the anode current but the current of one of the medium dynodes.

Both Geiger counters and the first scintillation counter were located inside a housing of aluminum one gr/cm^2 thick. In addition about 20 percent of the total solid angle was screened by a large quantity of matter (~ 10 gr/cm^2). The second scintillation counter was located outside the housing. The scintillator 0.3 gr/cm^2 thick was covered on the side of free space by an aluminum foil 7 μ thick (1.9 mg/cm^2).

The specified device was used only for measuring the total ionization. In the case of recording an electron stream with energies within the range of 100 — 1,000 kev, the indications of the device would give an energy flux carried by these particles within a solid angle of 1.8 sterad. The electronics of all devices (amplifiers, computing schemes, and elements for coordination with telemetry) were made with semiconductors. The resolving power of the converting cells was 10^{-4} sec.

This article will deal with results of preliminary processing of data related to a distance range of 8,000 — 150,000 kilometers from the Earth's center.

1. The Spatial Location of the High-Intensity Zone

Inasmuch as the motion of particles is determined by the magnetic field, it is natural to represent the results of measurement of the emission intensity not in geographical, but in geomagnetic, coordinates. Figure 1 shows the trajectory of the motion of the rocket in relation to the terrestrial magnetic field.

It is seen in Figure 1 that the maximum of intensity is reached at a distance of $\sim 26,000$ kilometers from the Earth's center. At a distance of 55,000 kilometers, the intensity of the terrestrial corpuscular emission becomes practically equal to zero (it will be shown below that the residual ionization at this point, which does not vary in further flight, is entirely due to cosmic radiation).

It is obvious that the intensity is determined not only by the distance from the Earth's center, but to no less extent, also by the factor on what magnetic force line the measurement occurs. Since the motion of particles should occur along a spiral winding along a force line, then knowing the intensity in some point of a given line, it is possible to make some quantitative conclusions as to the intensity in its other points. Thus, for example, from the fact that the intensity along the force line 70° (we shall designate a force line by the geomagnetic latitude on which it intersects the terrestrial surface) in the intersection point of the force line with the rocket trajectory ($R = 53,000$ kilometers) is close to zero, it follows that along this force line, the intensity is also close to zero. We assume here that the particles perform oscillations along the force lines symmetrically in relation to the equatorial plane.

An experimental proof of this assumption may be found in that the intensity grows along a specified force line while moving from low altitudes to high ones. Thus, for example, the intensities in various points of the force line of 60° for altitudes of 400, 1,800, 5,600 and 14,000 km over the terrestrial surface have the ratio of 1 : 20 : 200 : 700 (the data for the two first altitudes were obtained by the third satellite).

Such intensity variation along a force line indicates that the particle stream is not directed one way; in any case, a major part of the particles undergoes full reflection upon approaching the Earth and correspondingly performs oscillations from one hemisphere into the other. In this process, oscillations of lower amplitude are represented by a larger amount of particles. This may be explained in that the life time and, accordingly, the factor of agglomeration decreases with growing amplitude (in particular because of absorption in the denser atmospheric layers).

In our experiments carried out on the third satellite [1] it was revealed that the terrestrial corpuscular emission should be divided into two zones, differing in their spatial distribution, as well as in the composition of the particles. With regard for the relatively low altitude of the satellite flight, these zones have been called the polar and the equatorial zones. In analyzing this phenomenon, it seems better to call these zones the internal and the external. The boundary of the equatorial (internal) zone passes at an altitude of 1,000 kilometers at a latitude of 45°, and it is natural to assume that from the high-altitude side the boundary of this zone is formed by the force line of 45°.

It is seen from Figure 1 that the rocket trajectory nowhere intersects the internal zone. And, indeed, as it will be shown below, the cosmic rocket devices did not in any part of the trajectory record high energy particles characteristic for the internal zone. (These particles in the internal zone seem to be protons, produced on account of neutron decay; see [4])

On the other hand, the composition of the emission appeared to be rather close to that which was observed on the third satellite in polar regions. On the satellite, there was experimentally revealed at altitudes of 400 and 1,800 kilometers a rather sharp boundary of the polar zone of high intensity at latitude $\sim 55°$. It may be seen from Figure 1 that during the flight of the cosmic rocket at an altitude of about 7,000 kilometers, when the trajectory approaches the force line of 55°, a tendency to an intensity decrease is observed. Therefore, the external zone of the terrestrial cospuscular emission should be imagined as located in the space between force lines $\sim 55°$ and $\sim 67°$. The maximum intensity is observed on the force line $\sim 62°$.

2. The Composition of the Emission in the External Zone of High Intensity

Figure 2 shows the instrument readings in relation to the distance from the Earth's center. For the curves I, II, and V, a correction is introduced for miscounts, with application of calibrations carried out before launching. In the region of maximum the tempo of counts along the channels I, II, and V is close to saturation; thus, the correction for miscounts becomes uncertain, and in this region, the curves are disrupted.

Since the spectrum of pulses in the scintillation counter appeared to be very soft and the resolving time of the discriminators was 10^{-4} sec, it is indispensable to take under consideration the possibility of overlapping of pulses in time.

By using the section 40,000-50,000 kilometers, we may obtain the following evaluation of the spectrum : N(> 45 kev) ; N(> 450 kev) ; N(> 4.5 Mev) = 1 : 10^{-2} : 10^{-5}. These data and the comparison of the counting tempo and ionization show that the basic part of energy falling on the crystal belongs to X-rays of ~ 100 kev energy or less. Further improvement of the spectrum may be realized by taking into account data from the Geiger counter. During calibration within the energy range of 20 to 100 kev, our counter indicated, in comparison with the ionization measurement (IV), a rising efficiency at a lower hardness of X-rays. Therefore, the correlation of the counter indications and the ionization provide an opportunity for evaluating the effective energy of X-rays. This evaluation yields for the altitude range of 40,000-50,000 kilometers 50-60 kev. Therefore, the ionization produced under the casing occurs on account of radiative capture produced in the electron absorption of ~50 kev energy in the screening aluminum casing.

Figure 2 gives some indications that the electron spectrum is not constant at various altitudes. This is shown by the varied behavior of curves IV and V. In the maximum region at distances of 11,000-36,000 kilometers from the Earth's center, the ratio of ionization to number of counts by the counter decreases, which circumstance, as mentioned above, indicates a decrease of X-ray hardness. The evaluation of hardness at the maximum of the measurable value of counting (at a distance of 12,000-33,000 kilometers) gives a value of 25 kev.

Therefore, there are some indications that in the middle of the external zone, where the particle density is highest, the effective electron energy is minimum. The existing rise of curve III in the range of 20,000-30,000 kilometers does not show the appearance of high-energy particles, because such behavior of the curve is explained by pulse overlapping at the intensity which occurs at the maximum.

In the region of the maximum, the hardness evaluation may be processed by introducing the data of the second scintillation counter. This counter measured at maximum intensity an energy flow of $2 \cdot 10^{11}$ ev/cm^2 sec sterad. The energy flow under the aluminum layer of 1 gr/cm^2 (according to data IV) equals $1.5 \cdot 10^9$ ev/cm^2·sec.sterad.

The correlation of the measured energy flows is determined by the aspect of the energy spectrum of incident electrons. By keeping in mind that the second counter effectively records only electrons with energy over 50 kev, while the effectiveness of the first counter within the range 20 to 100 kev varies considerably more loosely, an evaluation of the spectrum aspect in the specified energy range can be made: If we represent the integral energy spectrum of electrons in the form $N(>E) \sim E^{-\gamma}$ then $\gamma \sim 5$. For sections with lower intensity, on the edges of a zone, the spectrum is noticeably harder ($\gamma \sim 3$).

We should remark that the energy flow measured by the second scintillation counter does not quite agree with data obtained by Van Allen on the fourth US satellite [2]. These measurements yielded an energy flow of 10^{13}ev/cm^2·sec/sterad. The difference in the foil thickness (in the device of Van Allen 1 mg/cm^2) can hardly explain a difference by a factor of 100, which is even further widened by the large difference in flight altitude. If we do not consider the essential difference in time and the locale of the experiment, which makes comparison more difficult, but consider the cause for the divergence to be the different thickness of the foil, then we could assume the presence of slow neutrons with paths in the range of one to 1.9 mg/cm^2.

3. Cosmic Rays

As seen from Figure 2 during recession of the rocket from the Earth, starting with a distance of 66,000 kilometers, the intensity of all components remains constant. The slight monotonic lowering of curve IV is not a response to variation of ionization but appears to be an instrument effect connected with the long afterglow of the crystal NaI(Tl) [1]. The strict stability of the intensity of all components in the range of distances 66,000-150,000 kilometers shows that we are dealing with emission on which the terrestrial magnetic field has no effect at such distances. This signifies that either the terrestrial magnetic field "disappears" at a distance of 10 radii (for example on account of the existence of an interplanetary field of strength $3 \cdot 10^{-4}$ oerst), or, in the cosmos, more accurately, in interplanetary space, particles of energy within the range $1.5 \cdot 10^8 - 4 \cdot 10^7$ ev/c are missing (if we assume that the dipole field extends to 20 earth radii).

The number of charged particles of cosmic rays recorded by the Geiger counter is 2.3 particles/$cm^2 \cdot$sec and, according to data of the scintillation counter (curve III), 1.9 particles/$cm^2 \cdot$sec. The slight difference of these data is explained by the fact that the relativistic proton, passing through the edge of the crystal, may lose the energy below the threshold energy of 4.5 Mev; the introduction of a correction for the decrease of effective cross section of the crystal sets these data in agreement. Therefore, the flow of primary cosmic particles is 2.3 ± 0.1 particles/$cm^2 \cdot$sec. -- the error characterizes the uncertainty in the dimensions of counter and crystal -- or 0.18 ± 0.008 particles/$cm^2 \cdot$sec$\cdot$sterad; this value agrees well with measurements carried out on balloon sounds in the stratosphere at high latitudes [3] and shows that the somewhat high value of intensity in rocket tests is connected to the albedo from the atmosphere. The photon intensity (after deduction of pulses bound to penetrating particles) amounts, within the range of 45 - 450 kev, to 3.2 ± 0.1 photons/$cm^2 \cdot$sec and, within the range of 450 - 4500 kev, to 1 ± 0.1 photon/$cm^2 \cdot$sec. These numbers give an evaluation of intensity of the X-ray and gamma emission in cosmic space. However, it is not excluded that a significant part of the recorded photons, particularly within the range of 450 — 4500 kev, is produced by cosmic rays in the matter surrounding the crystal. The role of this effect is at present being defined more accurately.

The photon energy flux is rather low and practically does not introduce any contribution to ionization. The ionization in the crystal is $1.42 \cdot 10^9$ ev/sec or $8 \cdot 10^6$ ev/g.sec; the mean ionization of particles is $3.5 \cdot 10^6$ ev.cm^2/g, which exceeds by 2.5 times the minimum ionization in NaI. The higher ionization is explained well by the presence in the composition of primary cosmic rays of alpha-particles and heavier nuclei, taking into account that a part of them are not relativistic. -- Submitted 25 February 1959

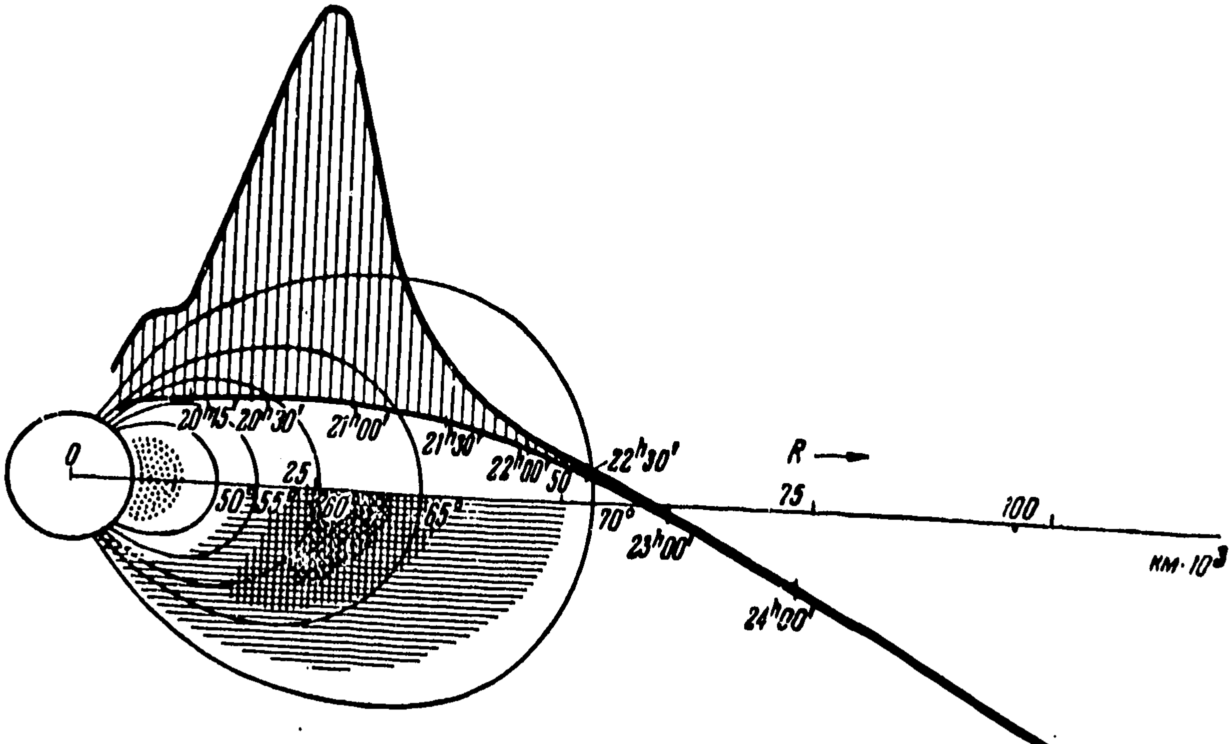
BIBLIOGRAPHY

1. S. N. Vernov et al. Iskussetvennyye sputniki Zemli (Artificial Satellites of the Earth) Symposium 2; report at the Fifth IGY Assembly

2. Van Allen, et. al., report at the Fifth IGY Assembly

3. A. N. Charakhch'yan, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 35, 5 (11), 1958

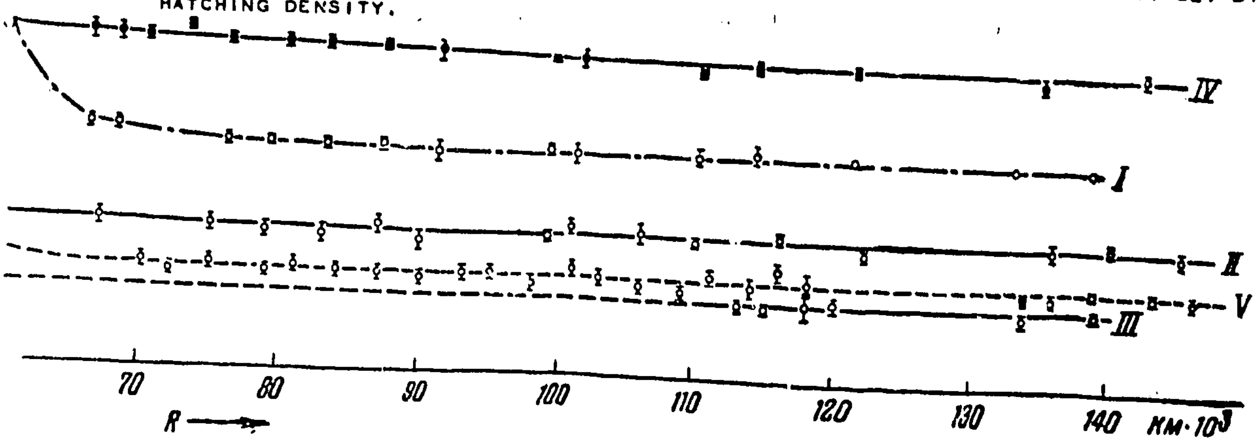
4. S. N. Vernov, N. L. Grigorov, I. P. Ivanenko, A. I. Lebedinskiy, V. S. Murzin, A. Ye. Chudakov, Doklady Akademii Nauk SSR, 124, No 5, 1959



[JOIN PAGE 9 HERE]

FIGURE 1. TRAJECTORY OF THE ROCKET IN GEOMAGNETIC COORDINATES.

ALONG THE TRAJECTORY, FLIGHT TIME (MOSCOW) AND INTENSITY VERTICAL LINES EXTENDING TO THE TRAJECTORY) ARE SHOWN. TOTAL IONIZATION (IV) IS SHOWN AS A MEASURE OF THE INTENSITY. THE DRAWING INCLUDES MAGNETIC FORCE LINES INTERSECTING THE EARTH'S SURFACE AT GEOMAGNETIC LATITUDES OF 50, 55, 60, 65 AND 70°. THE MAGNETIC FIELD IS TAKEN AS THE DIPOLE FIELD WITH GEOMAGNETIC POLE COORDINATES 78.5° N AND 69° W. THE INTERNAL ZONE IS SHOWN BY DOTS, THE EXTERNAL BY HATCHING. INTENSITY DISTRIBUTION IN THE SECOND ZONE IS SHOWN QUALITATIVELY BY HATCHING DENSITY.



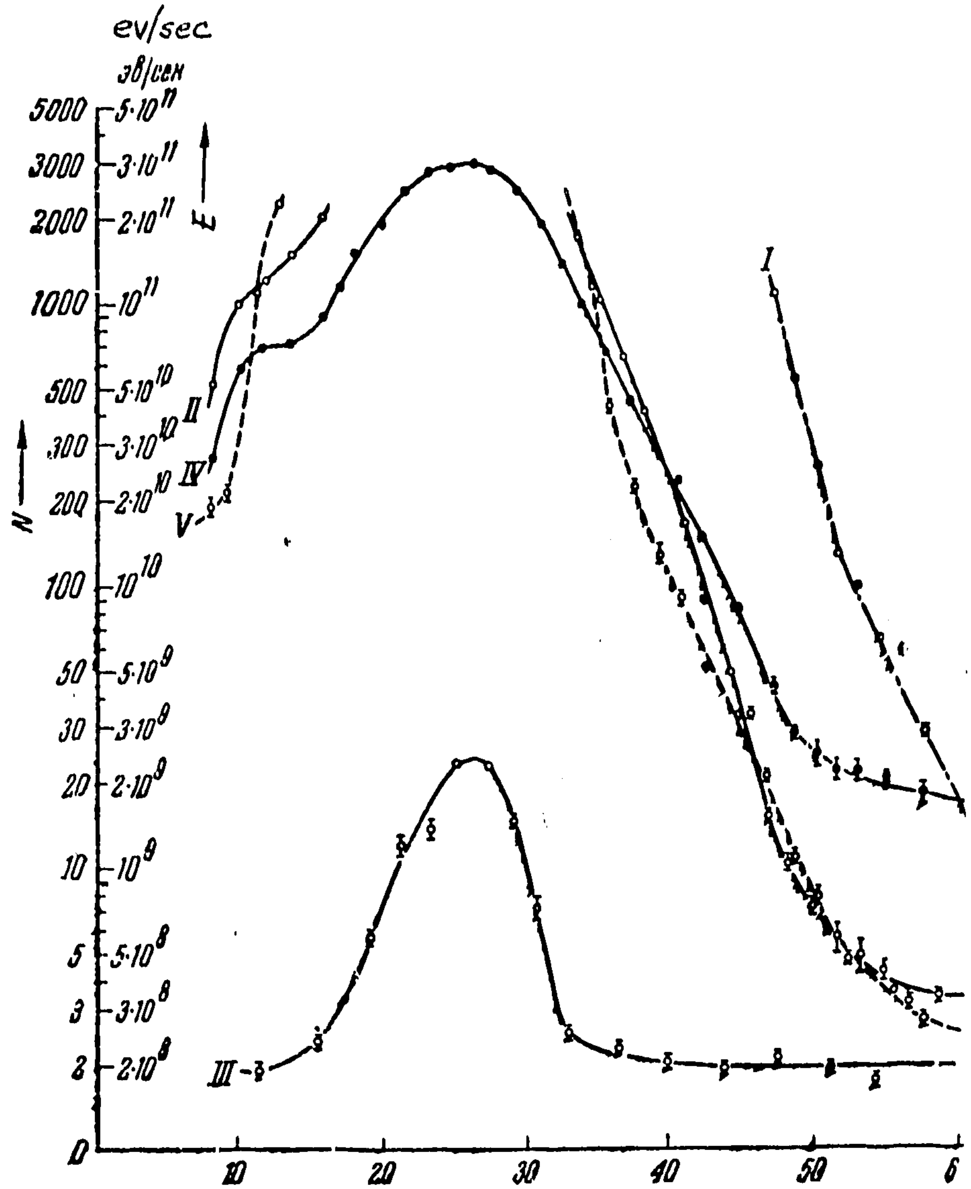


FIGURE 2. RELATIONSHIP OF INTENSITY TO ALTITUDE.

R- DISTANCE TO EARTH'S CENTER; I, II, III- COUNTING TEMPO WITH THRESHOLD OF 45 KEV, 450 KEV, 4.5 MEV RESPECTIVELY; COUNTING TEMPO IS REFERRED TO UNIT OF CROSS SECTIONAL AREA OF CRYSTAL (19 CM^2); IV-TOTAL IONIZATION (FULL ENERGY LIBERATION IN CRYSTAL PER SECOND); V-GEIGER COUNTER READINGS. THE NUMBER OF PULSES IS REFERRED TO UNIT OF COUNTER CROSS SECTIONAL AREA (4 AND 15 CM^2). THE READINGS OF THE TWO COUNTERS ARE IN GOOD AGREEMENT. DATA FROM THE SMALL COUNTER ARE USED IN THE CASE OF HIGH INTENSITY.

[ADJOIN PAGE 8 HERE]

Approved For Release 1999/09/08 : CIA-RDP82-00141R000200650001-1

("Study of Terrestrial Corpuscular Radiation and Cosmic Rays During Flight of the Cosmic Rocket," by S. N. Vernov, Corresponding Member of the Academy of Sciences USSR; A. Ye. Chudakov; P. V. Vakulov; and Yu. I. Logachev; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 2, 11 Apr 59, pp 304-307)

Kukarkin Discusses Cosmic Rockets and Astronomical Problems

"The lauching of the first Soviet interplanetary cosmic rocket on ~~2 January 19~~59 is an exceptionally important event in the development of astronomy." Elaborating on this theme, Prof B. V. Kukarkin, Astronomical Council of the Academy of Sciences USSR, goes on to say that in reaching the second cosmic velocity, that is the velocity necessary for overcoming the Earth's gravitational field and becoming an independent body of the solar system, the possibility of conducting direct observations of the Moon's magnetic field and its radioactivity appeared for the first time.

The artificial earth satellites have already made it possible to solve many earlier unsolvable astronomical problems. The possibility of leaving the magnetic and gravitational fields of the Earth and the Moon infinitely enlarges the problems of astronomy.

The penetration into space makes it possible to study cosmic rays in the same form in which they are propagated in interstellar space. The same is true in relation to the corpuscular radiation of the Sun, which plays such an essential role in the behavior of the ionosphere of the Earth, the appearance of the auroras, the disruption of radio communication in the short waves, etc.

The creation of cosmic rockets will make it possible to obtain an answer to still another problem of exceptional importance, the nature of interstellar and interplanetary gas. A very essential role is played by interstellar gas in our galaxy. Our knowledge of it is still very scant because investigations of it are difficult in the absence of direct methods of observation. Certain of its properties have been explained by different methods, but a precise and over-all presentation of interstellar gas does not exist at present.

The problem of landing a cosmic rocket on the surface of the Moon, and, in the future, on the nearest planets, is now technically soluble. This will lead to the direct solution of a number of burning problems which have excited man for a century: the problems of life on other planets, the origin of structures on the surfaces of the Moon and the planets, the problems of magnetic fields, and many others.

The surmounting of the next phase in rocket engineering, the achievement of the third cosmic velocity and the entry into interstellar space, is conceivable. Taking advantage of the Earth's mean velocity of 29.8 kilometers per second, a rocket with a velocity of more than 12.3 kilometers per second, accurately guided in the direction of the Earth's movement, can leave the limits of the solar system. It should be remembered, says Kukarkin, that the motors must sustain the necessary velocity up to the moment when the gravitational field of the Earth can be ignored. Practically, it is probable that it will be more suitable to accelerate such cosmic rockets up to higher velocities at the start.

The creation of cosmic rockets capable of reaching the nearest stars will obviously be connected with the search for new sources of energy which will give velocities equal to the speed of light. In this case, it will be possible to launch rockets to the nearest stars, among them being many of the so-called nonstationary stars in which the interesting processes connected with the sudden release of nuclear energy is taking place. They have much in common with the processes observed on the Sun in the form of "solar flares," but the scale of these processes on the nonstationary stars exceeds that of solar flares by hundreds of millions and billions of times.

Experiments connected with Einstein's theory of gravitation are conceivable. Classical celestial mechanics describe the motion of all the bodies of the solar system with sufficient accuracy. And relativistic corrections in calculations of the motion of bodies in the solar system are negligibly small. This occurs because the gravitational fields in which these motions take place are not very large.

However, Mercury, the planet nearest the Sun reveals a phenomenon not explained by Newton's classical theory of gravitation, the shifting of the longitude of the orbit's perihelion. The magnitude of this shifting corresponds almost precisely to the value predicted by Einstein's theory of gravitation.

The idea of creating a small artificial planet which would move according to an ellipse with very large eccentricity and would pass sufficiently close to the Sun is fully conceivable. In such a case, the relativistic effects in its motion would be more noticeably apparent than effects observed on bodies of the solar system.

Prof Kukarkin touched on only a few of the problems which arose for astronomers in connection with the creation of the first artificial planet by the Soviet Union. ("New Phase in the Building of Communism, Launching of Cosmic Rockets and Astronomical Problems," by Prof B. V. Kukarkin, Astronomical Council Academy of Sciences USSR; Moscow, Priroda, No 3, Mar 59, pp 7-8).

Soviet Popular Science Film on Space Research

A new short film, "Four-Legged Astronauts," issued by the Moscow Studio of Popular Science Films tells of the research work of Soviet scientists in space research and the use of dogs as the first astronauts.

The film shows how Soviet scientists solve problems of the conquest of cosmic space in their laboratories and preparations for the launching of Sputnik II. The scientists approached their goal step by step. Training and conditioning animals for ascents to great altitudes proceeds gradually. Birds, rabbits, and then dogs undergo the effects of low barometric pressure in pressure chambers; the effects of acceleration on them is studied by means of centrifuges; and the action of catapulting on living organisms is studied.

A film sequence shows the testing area. A rocket is being launched. Today, says the account, it will carry small travelers, two dogs, into the stratosphere. Scientists on the ground conduct observations of the animals in the rocket. The strange outlines of the signals appear on the oscillograph tube. Close by the bank of oscillographs, there is a recorder. It records data on the respiration and blood pressure of the animals. On a television screen, the observer and the viewer of the film can see how the dogs behave during the flight. The rocket reaches an altitude of 220 kilometers. The nose cone automatically separates and begins to fall. A parachute opens and lowers it safely to Earth. When the hatch of the hermetically-sealed cabin is opened, the dogs are shown unharmed.

The training of the dogs for flights in artificial earth satellites is shown, and, finally, the launching of the rocket bearing the dog Layka into its historic flight orbiting the Earth. ("Film on Scouts of the Cosmos," by I. Tolmacheva; Moscow, Sovetskaya Aviatsiya, 14 Apr 59, p 4, and "Four-legged Astronauts," by Mikh. Dolgopolov; Moscow, Izvestiya, 12 Apr 59, p 4)

Czechs Now Decoding Sputnik Signals

An article, appearing in Obrana Lidu a Czech newspaper, which briefly discusses the history and current development of solar batteries for transmitters used in artificial earth satellites, mentions, almost in passing, that the signals transmitted by Sputnik III, which has just concluded 4,035 revolutions around the Earth, are now also being decoded by the Czechs, since USSR scientists have made all the codes for the Sputnik radio signals available to Czechoslovak scientific workers.

The article also states that Soviet-type solar batteries are also now being made by Czechoslovak scientists. ("The Sun, a Coworker of Scientists," Prague, Obrana Lidu, 1 Mar 59, p 1)

III. UPPER ATMOSPHERE

Latvian Astrophysical Observatory To Expand Operations

An article by Ya. V. Peyve, Corresponding Member of the Academy of Sciences USSR and President of the Academy of Sciences Latvian SSR, gives an account of the part the Academy of Sciences Latvian SSR and Latvian scientists will play in the programs of the Seven-Year Plan.

The Astrophysical Laboratory of the Academy of Sciences Latvian SSR will study the complex problem of the structure and development of stellar systems and the metagalaxy. The laboratory will acquire a new observatory in the Baldone region and will expand its own investigations according to the most important problems of modern astronomy. The physical studies originating in the cosmos will be studied and new methods and means of astronomical investigations with the aid of modern scientific appratus will be developed. ("Development of the Natural Sciences in Latvia," by Ya. V. Peyve, President of the Academy of Sciences, Latvian SSR; Moscow, Priroda, No 3, Mar 59, pp 9-14)

Use of Motion Pictures in Astronomical Investigations

The 12th Congress of the International Association of Scientific Motion Pictures was held in Moscow in September 1958 concurrently with the International Festival of Popular Science Films. A report on the congress appearing in the Soviet periodical Priroda describes the use of motion pictures in astronomy and cosmonautics. Part of this account concerning Soviet work in the field is given here.

A narrow-band monochromatic interference-polarization filter was perfected by A. B. Severniy, Corresponding Member of the Academy of Sciences USSR, and A. B. Gil'varg, scientific associates of the Institute of Crystallography of the Academy of Sciences USSR, in 1947-1948. This filter narrowed the transmission band down to 1.8 Anstroms and, in 1950 down to 0.5 Angstroms. With the aid of such perfected filter, A. B. Severniy conducted measurements of solar prominences by means of motion picture recording.

A short report by Severniy and A. Ye. Balkov, "Use of Motion Picture Surveys in Studying Processes on the Sun at the Crimean Astrophysical Observatory of the Academy of Sciences USSR," was illustrated by a film in which chromospheric flares and prominences had been recorded. A report by N. I. Grishina, scientific associate of the Institute of Applied Geophysics of the Academy of Sciences USSR, described material on motion picture surveys of noctilucent clouds. Grishina showed a film in which a unique motion picture survey of noctilucent clouds was included. It was as a result of these surveys that the wave motions of noctilucent clouds was discovered. ("Methods of Scientific Motion Picture Investigation," by I. V. Sokolov, Candidate of Mechanical Sciences; Moscow, Priroda, No 3, Mar 59, pp 55-60)

Conference on the Scintillations of Stars

A scintillation and quivering of the "images" of radio sources which leads to a limitation of the limits of accuracy of radar and radio navigation devices has been observed which is similar to the scintillation and quivering of star images.

The All Union Conference held in Moscow in 1958, which was organized by the Astronomical Council of the Academy of Sciences USSR and the Institute of the Physics of the Atmosphere, was devoted to all of these extremely essential problems of astrophysics and radiophysics.

The turbulent structure of the atmosphere causing the phenomenon of star scintillation and the quivering of their images and also of other astronomical objects, reduces the quality of the observations. Turbulence also has a varied effect on the propagation of ultrashort radio waves.

The reports and papers presented at the conference contained the results of theoretical and experimental investigations of the turbulent structure of the troposphere, observations of scintillations and quivering of star images and the study of the astroclimate of the USSR connected with these problems. Part of the reports were devoted to disturbances during solar observations caused by the turbulence of the atmosphere. In addition, reports were made on the use of a new photoelectrical and television technique for registering the instability of star images, and also on electronic instruments ensuring statistical analyses of fluctuated magnitudes and on an electron-optical apparatus for automatic telescope sighting.

A report by V. P. Kinin, arousing great interest, dealt with the coming possibilities for compensating unstable stellar images and obtaining a steady image of astronomical objects, thus achieving full use of the resolving capabilities of large telescopes, as for example in observing the surfaces of planets.

The importance of the future study of the USSR's astroclimate on which the final goal of this study, the creation of a map of the astroclimate of the USSR and adjoining countries, was created, was emphasized in the resolution adopted by the conference. ("Conference on Scintillation of Stars," by A. I. Zin'kovskiy; Moscow, Priroda, No 3, Mar 59, p 114)

IV. METEOROLOGY

Use of Radar in Weather Surveys

The use of radar in weather surveying in the region of flights is described in an article in Sovetskaya Aviatsiya. Radar is used to observe cloudiness and to determine the wind force and direction at various altitudes. The flight region is surveyed prior to takeoff. The use of an inclinometer is used to determine the altitudes and limits of clouds. Pilot balloons are used for wind measurements. The principal shortcoming of this last method is that pilot balloon data in meteorological surveying are not obtained continuously but over a certain period of time. In addition, measuring the wind at high altitudes requires a rather long time for the pilot balloon's ascent and for the processing of the obtained results. The authors describe their method of more rapidly furnishing air crews with necessary data on the wind.

This is accomplished by loading standard signal rockets with a special compound possessing good reflective capability and a slow rate of settling, in place of the usual luminous charge. With such rockets on board, the crew of an airplane can, at any moment, establish contact with ground radar stations for beginning joint determinations of wind measurements.

On receiving the ready signal, the crew commander releases a rocket. The radar operator picks up a bright spot on his screen. It is the pulse reflected from the rocket's compound. Conducting continuous observations he fixes the azimuth, distance, and height of this point each minute. Usually the observations last 3-8 minutes.

The coordinates of the luminescent marks which are obtained are placed on the azimuth grid for determining the direction of the wind. The points are joined by a line and then, by using dividers and ruler, the direction of the wind is determined.

The force of the wind can be found if the difference of the remoteness of the first and second points is divided by the time between readings and by the cosine of the angle of displacement of the second point relative to the first point. The accuracy in determining wind force and direction by this method is equal to that in using pilot balloons. In practice, after the rocket is shot from the airplane, the coordinates noted by a circular sweep radar, are transmitted to the radar station operating with pilot balloons. The wind station operator observes the descending rocket, conducts the usual recording (as with the pilot balloon), processes the data, and transmits them to the airplane crew.

This method of determining wind velocity and direction can be used during the performance of parachute jumps and also for studying winds in the stratosphere. ("Radar Surveying the Weather," by Lt Col P. Grinev and Maj G. Krovchuk; Moscow, Sovetskaya Aviatsiya, 7 Apr 59, p 2)

New Soviet Book on Meteorology

Reviews of the book Letchiky o Meteorologii [Brochure on Meteorology], appeared in a recent issue of Sovetskaya Aviatsiya, by Eng-Col M. Ioffe, Docent, Candidate of Geographical Sciences, and Eng-Maj F. Lysenko. Despite certain omissions and shortcomings, which are pointed out, the book is favorably reviewed by both critics.

The need for a manual which, in a practical form and in a definite methodical sequence, presents all the complex problems determining meteorological flight conditions is fulfilled by this work. The author has revised and considerably expanded his first book, using materials of the latest achievements in meteorological science. Chapter one is devoted to a review of information on the atmosphere. The methods of its investigation are considered more in detail, including the use of rockets and artificial satellites. A modern presentation of the composition and structure of the atmosphere is given. The basic meteorological elements and their distribution in the atmosphere, as well as data of a standard atmosphere, are presented. Practical explanations of the basic characteristics of various cloud forms and their variability in time and space are given. Of particular interest is the description of flight conditions with different forms of clouds and fogs, and also the conditions for the formation of condensation trails by airplanes. Chapters 4, 5, and 6 are the most original and informative. Here, for the first time, such important physical phenomena for aviation as the jet streams, atmospheric turbulence, storms and squalls, and also icing of airplanes and helicopters are given in sufficient detail for the first time, taking into account the experience and results of the latest theoretical investigations. In considering the classification structures of jet streams, the author indicates possible regions and levels of finding these currents of air and their parameters.

The book insufficiently explains the problems of maps of barometric topography. It gives the formula for finding the velocity of the gradient wind at heights of 1,000 to 1,500 meters only and not how gradient winds are calculated for altitudes corresponding to the levels used in modern aviation. The material in Chapter 7, under the heading "Evaluation of Meteorological Conditions," is not methodically presented, as the examples given therein do not carry out the author's aim. The examples give only the actual state of the weather along the flight route and the weather forecast prepared by the meteorologist. From a training viewpoint, this is completely inadequate, as before a flight is undertaken, all synoptic and aerological materials and weather survey data must be considered. In Ioffe's opinion, Kravchenko should have presented at least one example of the consecutiveness of an analysis of synoptic maps and the map of a baric topography in forming an opinion on the possibility of weather changes along the flight route or in the flight region. ("Book on Meteorology," by M. Ioffe, and "Certain Observations," by F. Lysenko; Moscow, Sovetskaya Aviatsiya, 2 Apr 59)

Short-Range Forecasts of Atmospheric Pressure Fields

A three-level (250-, 500-, and 700—millibar) model of the atmosphere is used for forecasting the fields of atmospheric pressure for 24-48 hours on the basis of the determination of linearized systems of equations of hydrothermodynamics. The condition of extremal vertical velocity at the 500-millibar level is used for determining the initial closed system of differential equations. The solution is provided in analytical form, on the basis of which a method is proposed for preparing forecast charts of the absolute topography of isobaric levels. ("Short-Range Prognosis of the Fields of Atmospheric Pressure for a Three-Level Model of the Atmosphere," by S V Nemchinov, Institute of Applied Physics, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 3, Mar 59, pp 432-44.)

V. GRAVIMETRY

Model of Sea Gravimeter Described

A description is given of the design and operating principles of a model of a string gravimeter for use in gravimetric surveys at sea. The instrument, which has an automatic recording of the frequency of the oscillations of the string, was built at the All-Union Scientific Research Institute of Geophysical Methods of Prospecting, Moscow, which is under the Ministry of Geology and Mineral Resources USSR.

To a vertical string made of beryllium bronze, 0.02-0.37 millimeter in diameter and 52 millimeters long, a weight of about 70 grams is suspended. The upper end of the string is firmly attached to the frame. With given parameters, the frequency of the transverse oscillations of the string is about 1,000 cycles per second. To provide a damping of the weight, which is extremely important in measurements at sea, the weight is made of copper in the form of a circular disk with a downward projecting rim. Arranged symmetrically around the weight are four damping magnets, the field of which permeates the weight both in the vertical and in the horizontal direction. To prevent a horizontal rotataion of the weight around the axis of the string, the weight is connected to the frame by means of fine horizontal threads or thin, flat horizontal springs. A P6-A oscillator circuit is used, together with a battery (4-4.2 volts, 1.5 milliamperes). Atmospheric influences are excluded by sealing the instrument in a vacuum chamber (10^{-2} mm [Hg]). The temperature coefficient of the string amounts to about 0.008 milligal/degree. A series-potentiometer distance indicator, type PDK-49, is used for the automatic calculation of the number of periods, i.e., the difference between the number of oscillations of a reference sinusoidal voltage and of the string of the gravimeter. The string is suspended between the poles of a permanent magnet, the lines of force of which are horizontal and parallel to the longitudinal axis of the string. If the string oscillates across the lines of force, between its ends, an alternating voltage will be produced with a frequency equal to that of the vibration of the string. The voltages produced at the ends of the string are amplified, and a part of them is fed back to the string in the same phase to sustain the oscillations.

The first survey afloat made with the string gravimeter was completed in the period 29 October-6 November 1956 in the Caspian Sea along the route from Baku to Astrakhan' on board the tanker "Agamali-Ogly," which displaces 12,000 tons. The accuracy of the measurements could not be determined, since the instrument had a number of shortcomings which greatly reduced its accuracy, even in stationary operation. When the survey data obtained on board was processed back at the institute, the correction for the deviation of the zero point of the instrument was not taken into account, since repeated readings at the point of origin in Baku fell within the limits of the general accuracy of the model.

To be completely reliable for use at sea, this string gravimeter must have, in addition to design improvements and a gimbal suspension, a means of recording the horizontal acceleration of the instrument and its inclination. ("String Gravimeter for Measuring the Force of Gravity at Sea," by A. M. Lozinskaya; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 3, Mar 59, pp 398-409)

VI. SEISMOLOGY

Development of Scientific Investigations in Seismology

The study of earthquakes in the Soviet Union has progressed considerably in recent years, owing to the strengthening of the network of seismic stations. Scientific results on certain knotty problems of seismology have been obtained. An Atlas of the Seismicity of the USSR has been compiled, generalizing the results of the study of the seismicity of the country's territory, and the map of the seismic regioning of the country which now serves as guide material in construction in seismic regions has been improved. Special dispatches are sent to the seismic station Moskva on all strong earthquakes. Shortcomings in the organization and development of operations on seismology still exist. This was noted by the Presidium of the Academy of Sciences USSR in a resolution. Investigations in several directions are conducted very slowly. Despite the broad investigations and observations conducted in geophysical stations and in many expeditions, the search for methods of forecasting the origin of earthquakes has still not given positive results.

A number of measures for the future development of scientific works in the field of seismology were outlined by the resolution of the Presidium of the Academy of Sciences USSR. New seismic stations in the Far East, in the Baykal region, and in Altay will be opened in 1959-1958. The necessity of creating four to five geophysical (seismic) observatories of a high order of accuracy, equipped with systems of sensitive instruments for the detailed study of the seismic regime and the internal structure of the Earth was acknowledged. The geophysical station Alma Ata is being reorganized into a complex geophysical (seismic) observatory.

It has been proposed to the Institute of the Physics of the Earch that it accelerate the development of new methods of seismic regioning, to intensify the work on creating more perfected systems of seismic instruments from the recording of strong earthquakes and long-period waves, and also for the creation of automatic seismic stations.

The monograph Earthquakes in the Territory of the USSR, will be finished and published in 1959.

Prof Ye. F. Savarenskiy has been approved as chairman of the Council on Seismology of the Academy of Sciances USSR. ("Development of Scientific Investigations in Seismology"; Moscow, Priroda, No 3, Mar 59, pp 113-114)

Study on Determination of Azimuths and Angles of Emergence of Seismic Waves

Pointing out that the determination of the azimuths and angles of emergence of seismic waves has been considered an insufficiently reliable method of determining the location of epicenters of earthquakes and the changes of seismic wave propagation with depth, an article by two members of the Council On Seismology, Academy of Sciences USSR, discusses the determination of these parameters on the basis of seismic data recorded by 22 Soviet seismic stations for two earthquakes which occurred in 1957 in the Mediterranean area. The epicenters of both were located at 36 00 N and 28 30 E. The intensity of both quakes, according to the Soviet seismic stations, was 6 3/4. The quakes occurred on 24 and 25 April 1957.

In regard to the determinations of the azimuths by the Soviet seismic stations, in the majority of cases the amplitudes of the seismic waves measured on seismographs, amounted to several millimeters, and the measurement error for the azimuth could be about 3-4 degrees. A graph and table show the positions of all the seismic stations and of their estimated azimuths for the earthquakes. The largest error (minus 28 degrees) was made at Ashkhabad, while the error of the measurement made at Moscow State University was zero; the error at Yuzhno Sakhalinsk was only minus one degree, and that of Magadan only plus 4 degrees.

As far as the apparent angle of emergence of the seismic wave is concerned, the values obtained by the various stations for the two earthquakes were within the range of admissible error (plus-minus 5 degrees); exceptions were Simferopol', Ashkhabad, Bayram-Ali, Garm and Magadan, where the discrepancies for the angle of emergence of the two earthquakes amounted to 10 degrees, and the stations at Yuzhno-Sakhalinsk and Apatity, where the differences were 12 and 13 degrees, respectively. The various Soviet stations showed comparable errors in the measurement of the energy of the peaks of the two seismic waves.

Successful work on the dynamic characteristic of seismic waves requires, according to the authors, that Soviet seismic stations provide a more precise determination of the dynamic parameters and coefficients of amplification of their instruments. Another important problem is that of determining the actual period of the incident seismic wave. On the basis of the investigation made here, the approximate values for the apparent period of the wave, obtained on the basis of the moment of the onset of the first maximum, are not yet precise enough. ("On the Determination of the Azimuths and Angles of Emergance of Seismic Radiations," by Ye. F. Savarenskiy and I. V. Ayvazov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 3, Mar 59, pp 372-381)

VII. ARCTIC AND ANTARCTIC

Activities of Drift Stations in Arctic

Last-minute preparations are in progress at the Arctic and Antarctic Institute in Leningrad for the high-latitude aerial expedition "Sever-11." As in the spring of every year, meteorologists, oceanologists, and geophysicists are participating in this expedition. The 1959 expedition is headed by M. M. Nikitin, Candidate of Geographic Sciences, and the aerial support group is headed by P. P. Moskalenko.

As in previous years, the high-latitude aerial expedition will have two purposes: (1) replacement of the staffs of drift stations, and (2) physicogeographic exploration of the little known regions of the Arctic Ocean.

The drift station Severnyy Polyus-6, headed by S. T. Serlapov, is now located in the region between the North Pole and Zemlya Frantsa Iosifa, and is moving in the direction of the Greenland Sea. It is assumed that the ice island will be carried out into the sound between Greenland and Spitsbergen during the polar night of 1959-1960. By the spring of 1960, the drift station will be in the same area where the members of station Severnyy Polyus-1 were taken off their ice floe in February 1938.

The new staff of Severnyy Polyus-6 will be headed by V. S. Antonov, Candidate of Geographic Sciences. The scientific staff will study the geophysical, oceanological, ice, and meteorological regimes of a scientifically important region of the Arctic, i.e., the area adjoining the Atlantic Ocean. The interaction between the cold Arctic Ocean and the warmer Atlantic Ocean is especially noticeable in this region. This is the area of the fastest-moving drifts.

The members of station Severnyy Polyus-7, headed by N. A. Belov, who have courageously endured repeated break-ups of their ice floe during the past polar night, are completing their year of drift "on the other side" of the North Pole, about 400 kilometers from Ellesmere Land. This region is known for comparatively low speeds of drift.

At present, Severnyy Polyus-6 and Severnyy Polyus-7 are concentrating on the sector of the Arctic Ocean bordering on the Atlantic. They are no longer studying the natural processes in that part of the ocean belonging to the eastern section of the Northern Sea Route. Meanwhile, the aerometeorological and oceanological study of this zine, adjoining the Chuckchee Sea and East Siberian Sea, is essential for improving the quality of ice forecasts during the forthcoming Arctic navigation season. It has been decided, therefore, to discontinue operation of the station Severnyy Polyus-7 in April of this year. A new station, Severnyy Polyus-8, will be organized in its place. It will be established about 400-500 kilometers from Ostrov Vrangelya, in about the same location where Severnyy Polyus-2 started its drift in 1950. V. M. Rogachev, a weather expert, has been appointed head of the new station. He participated in the drift of Severnyy Polyus-7 from April 1957 to April 1958.

Most of the new station staff members are young people. However, they have already had considerable experience in Arctic work. V. Nikonov, 29 years old, who will be senior aerologist at Severnyy Polyus-8, has already taken part in two one-year drifts. L. Belyakov, oceanologist, a Komsomol, spent 2 years in the Arctic observatory on Spitsbergen and took part in the voyage of the Vityaz' in the Pacific. V. Uglev, second oceanologist, and also a Komsomol, was a member of several previous Arctic expeditions.

Since April 1954, there have always been two drift stations operating continuously in the Arctic Ocean. The Soviet scientific research stations "Severnyy Polyus" have spent a total of 3,330 days drifting in the ice of the Arctic Ocean, and have traveled about 25,000 kilometers with the floating ice.

Soviet scientists are continuing to receive valuable data for the solution of important scientific problems, mainly the problem of forecasts, which are necessary both for sea the air transport, and for other branches of the national economy. During the past 3 years alone, drift stations conducted over 21,000 meteorological observations, launched over 8,000 aerological radiosondes into the upper atmosphere, and took more than 3,000 ocean depth soundings. Automatic devices made about 100,000 registrations of the properties of ocean currents and took more than 40,000 measurements of the water temperature at various depths of the ocean.

During the IGY, the program of observations was expanded considerably. It was fulfilled successfully and was highly praised by scientific circles. The active methods of studying the nature of relatively inaccessible regions of the Arctic, which include the exploration of high latitudes by drift stations, have become a permanent part of modern science. -- P. Gordiyenko, deputy director of the Arctic and Antarctic Institute. ("3,300 Days on the Drifting Ice"; Moscow, Vodnyy Transport, 28 Mar 59)

Activities at Antarctic Stations

Scientific observations at the interior station Vostok are being continued by a new staff of scientists headed by Ignatov, Candidate of Geographic Sciences, who formerly took part in the drift of Severnyy Polyus-7. The station Komsomol'skaya has been reorganized from a permanent station into an auxiliary one. Only two staff members are stationed there at this time, who regularly transmit weather data needed by the pilots of Soviet planes flying on the Mirnyy-Vostok route.

Meteorologists at Mirnyy have recorded an interesting phenomenon, i.e., the current air temperature is twice as low [twice as cold] as during January-February of the preceding years. The shore ice between the Pravda Coast and the Haswell Islands has been preserved until now. ("Daily Life of Polar Workers in Antarctica"; Moscow, Pravda, 7 Feb 59)

Slava Circles Antarctica

The Slava whaling flotilla has completed its whaling operations beyond the Antarctic Circle in the area of Balleny Islands. The flotilla in now in Ross Sea and is headed east, toward Amundsen Sea and Bellingshausen Sea.

For the first time after 13 voyages, the Slava flotilla has circled the whole continent of Antarctica. The crews of the whaling vessels, including the scientific research ship Ivan Nosenko, are conducting observations under the IGC-1959 program. If ice conditions permit, the flotilla will approach Eights Coast in Bellingshausen Sea and will also investigate the existence of the disputable Swain's Island and Macy's Island. Together with the Slava flotilla, the Black Sea tanker Slavgorod is sailing around Antarctica.

In Bellingshausen Sea, near Peter I Island, the flotilla will be met by the tanker Ochakov, which will supply the whaling vessels with fuel for their return voyage from the Antarctic to Odessa. ("Slava Travels Around Antarctica"; Moscow, Vodnyy Transport, 24 Mar 59)

Ob' Conducts Oceanographic Studies

After completing the organization of the new Soviet station Lazarev on Queen Maud Land, the crew and scientists on the expedition ship Ob' left the Antarctic waters. The ship crossed the zone of floating ice and arrived at Capetown on 23 March.

During the crossing from Antarctica to South Africa, the scientists conducted repeated oceanographic studies on the meridional cross-section between Princess Ragnhild Coast and Cape Agulhas. The first of these cross-sections along the 20th degree East longitude was completed 2 years ago by members of the Antarctic marine expedition of the Ob'.

The Soviet ship remained 3 days in Capetown. After refueling and replenishing its water supply, the Ob' departed on 26 March on its return voyage to the USSR. ("The Ob' Near the Coast of Africa"; Moscow, Vodnyy Transport, 28 Mar 59)

* * *

Approved For Release 1999/09/08 : CIA-RDP82-00141R000200650001-1